terms and description of common self-evident operations, but a thorough and complete discussion of the philosophy of the thing—a searching inquiry into the elements of its cause and effect, its right and wrong, its better and worse.

Still, if all this appear complex, the complexity is only seeming; greater complexity than this is every day reduced to system in other knowledges; a clear head and precise pen would soon sort it into simplicity; and I can only say that I wish it were fairly and diligently and knowingly attempted. The successful result would be a benefit immensely to the learner as his most valuable teacher, and by no means inconsiderably to the most experienced practitioner as his standard of reference for guidance, suggestion, explanation.

Although I have stated my fancy of Mr. Donaldson's constructional maxims carrying with them a sort of disappointment from their fewness, yet it does not follow that we neglect the appreciation of them individually. Many of them present to the attention sound principles much neglected; in some those intimate with the subject will find the merit of valuable and suggestive novelty; while, generally, if they do not attract us more forcibly, they attract us thus, that they are good hints for inquiry; excellent texts, for instance, to found illustration, discussion, conversation, upon. If I could sufficiently depend upon my own judgment in minutiæ, there are several of these maxims upon which I should like to offer illustration and suggestion; but I will rather beg you to be contented with a more general notice.

Maxim 106.—"The rot in timber germinates in damp, expands in heat, but shrinks and dies in perfect ventilation," struck me as carrying, under very much the semblance of a truism, a valuable precept of practical application—the need for providing much more than is generally done for the ventilation of timber-work in a building. When we lay the end of a girder, with an inch or two of space round it, in the wall, we are only providing what, I apprehend, ought just as carefully to be provided in many cases where it seems to be never thought of. The decay which the opening up of an old house exposes, often even when it is not so very old after all, ought to set practical men thinking more than it seems to do.

No. 109. "Water is the most destructive agent to construction. There is no quantity so small which, if repeated, is not ultimately fatal." That buildings should be attentively kept water-tight cannot be too rigorously insisted upon. It is not sufficient that torrents of wet shall not be permitted to produce ruin in ten or twenty years; but drops are enemies, only differing in degree. What a pity it is, for instance, to see many of our mediæval churches in helpless ruin, through this insidious destroyer, beside others, where a little additional care—a stitch in time hundreds of years ago—results in preservation of the whole structure in its strength!

No. 110 relates to a similar subject,—"Our forefathers knew the connection between moisture and decay in soft material. Hence in the buildings of the districts where the soft stones prevail, the bottom courses of the walls will frequently be found to be formed of a hard and impervious stone, the strata of which are called by the quarrymen foundation-stone." Besides the injury which damp occasions in the structure of a wall, and the woodwork in connection with it, we have a more serious reason still for care in the prevention of the transmission of moisture from the ground, in the manifold discomforts so commonly to be met with in that *multum in parvo* of annoyances, a damp house. The precautions of eaves-gutters, so that the roof-water may not drip on the foundations, dry areas round the basement walls to provide against the direct transmission of damp to apartments underground, sloping the surface up to the walls so as to draw the surface water off from the building, and so on, are only the ordinary provisions in the case, although too frequently foolishly neglected; but, in all instances of general brick building, the common qualities of bricks are such excellent conductors of wet that there never can be harm, when the soil is at all more damp than dry, in providing for the non-transmission of moisture by some such means as a couple of courses of slates in cement just above the ground, a cheap preventive of the chance of a most serious evil.

Some will also have hollow walling—the bond-skeleton of the brickwork without filling in—to provide against the transmission of damp directly through the wall from driving rain; but I should be disposed to question the efficacy of this, except the ventilation of the interior of the wall be more depended upon than the mere lessening of the quantity of conducting surface. In exposed situations, as on the coast, an approved method of building is in two distinct thicknesses of wall (as, for instance, a 9-inch wall outside and a 4½-inch wall inside) with a clear space of about 3 inches between them, the two thicknesses being connected together by iron bonding ties. Special care is insisted upon, not only that there shall be no brick connection of the two thicknesses (except, of course, in the jambs of openings), but that no bats or rubbish shall be let fall into the interior space, lest the moisture should be carried through by such means; and openings are provided to be left during building in the outer thickness at the ground for removing any pieces of mortar, or such like, which may happen to be allowed to drop down. If this should wear a little of the appearance of affectation in some respects, yet, after all, it is to be remembered that in the matter of a damp house a very small amount of prevention is better than a vast deal of cure. Battening is, of course, quite another subject, and the most effectual preserver of dryness provided it be itself kept dry.

Maxim 120—"The Freemasons of the middle ages have established this principle of construction, that, with equal quantities of material, a thin wall, with buttresses, has greater strength and stability than a thicker wall without,"—is worthy of being kept in view in these days of economy.

Maxim 136—"The material available must frequently have determined the style of art;"—"the like consideration controls the introduction of more or less ornamental detail in edifices," deserves to be taken very much to heart by those who would aim at a true spirit of design. How seldom do we find an architect regulating his design by his materials; his principle is rather to choose his design from the standards, and then do a world of scheming to carry it out with the material prescribed! To keep strictly to the facts of the nature of the material is, one would think, a rule so merely axiomatic as to scarcely need mention; but in our day architects in general never think of it, their axiom is rather always to disguise your material in the likeness of a better—a fallacy most gross and unworthy of intellect!

A few good sentences are given on mortars, timber, and iron; but it is manifest that little can be compassed on subjects like these in space so small; the architectural world requires treatises on such subjects like those of Pasley on the first, and Tredgold on the others, simply professionalized.

Let me pass now from constructive science to the walk and conversation of the architect. And upon this and Mr. Donaldson's valuable lecture on it, I must be content to speak very briefly. In fact, I can do little more than reiterate his excellent precepts. In acquiring the knowledge of a profession, whose knowledges are so many and comprehensive, diligence, attention, perpetual inquiry, persevering research, are merely the absolute necessaries of advancement. In assuming the position of a practitioner in a profession, where shortcoming and makeshift and empiricism are so much more prevalent than sound knowledge and good confidence of skill, the utmost endeavour, after thorough and systematic acquirement, is what alone can produce honourable standing. And in self-advancement in a profession, where such a custom as our competition-system gives so many (too eagerly embraced) opportunities for self-advancement by dishonour, such counsel as Mr. Donaldson's to highmindedness, integrity, and ambition for true fame, is the surest in the end to be the best to follow. Everyone knows Professor Donaldson to be eminently the friend of the student; and he possesses not a prouder diploma in his collection than the acknowledgment of this. I will therefore conclude with the sentiment of my commencement, that in laying before you the remarks now completed, I have the advantage of feeling that my subject must have been to you most interesting; and when we thus favourably end our examination of his work, there is no harm, perhaps, in calling to remembrance, that we owe Mr. Donaldson additional honour for the kind countenance which our own Architectural Association obtained from him at its beginning, and the hearty expression of goodwill by which he inspired us with confidence, and in no small degree contributed important help.

ROBERT KERR.

WHAT ARE THE CROWS' NESTS FOR?

ORDNANCE SURVEY OF THE METROPOLIS.

THE Ordnance survey observatories (humorously designated "crows' nests" by the metropolitan wags), on the tops of some of the highest buildings in the metropolis, have latterly attracted a good deal of attention, and given rise to inquiries which shew that considerable misapprehension exists respecting them: this the following remarks may probably dispel.

In every extensive survey, conducted with a due regard to scientific accuracy, it is a matter of the first importance to determine with unerring correctness the relative distances and bearings of the principal or most conspicuous objects within the country or district to be surveyed. To effect this, the first operation is to measure a "base line"—that is, a straight or right line between two points, varying in length according to the extent of the survey and the facilities afforded by the nature of the ground for the measurement. As the accuracy of all the subsequent operations of the survey must necessarily depend upon the correctness of the measurement of the base, the most scrupulous care and many ingenious expedients are resorted to in order that the utmost practicable degree of accuracy may be attained. It is not here intended to describe in detail any of the important base measurements that have taken place in this or other countries; suffice it to say, that glass rods, deal rods, steel bars, steel chains, compensation bars (that is, bars of different metals so arranged that, like Harrison's Gridiron Pendulum, they counteract each other's expansion during changes of temperature), have been severally used in different countries in the operation.

The base line being measured, the next step is to connect its extremities by means of angles taken with theodolites or other angular instruments, with all the conspicuous objects visible; the relative distances and bearings of which with each other, and with the base, become thus determinable, by means of certain well-known trigonometrical formulæ. By selecting the most suitable of these observed objects for new observing stations, the calculated distances become, in their turn, base lines for expanding the operations of the "triangulation," until the whole country, by a connected line of observing stations, becomes united or interlaced by a perfect net work of triangles, the distances and bearings, the latitudes and longitudes of which are all unerringly ascertained.

This "triangulation" forms the basis or groundwork for an accurate detailed survey of the entire district or country over which it has extended, and obviously affords accurate data for detecting or eliminating all practical errors of measurement or other *detail*—operations which may, and inevitably will, in the progress of extensive works, creep in, with the most careful surveyors. It also affords the means, and the only means, of making a connected survey of a country or extensive district; that is of making (or giving the means of doing so) the several parts of which it is composed harmonize and fit together, which, without the binding power of a general "triangulation," would be impossible.

These preliminary observations being understood, the mystery of the appearance of the present metropolitan aerial visiters will at once disappear. They are simply taking angles with theodolites from the most commanding objects to the other remarkable objects, such as church spires, or towers, cupolas, factory chimneys, &c. &c., within the visual range of their instruments, for the purpose of ascertaining their relative bearings and distances; and where these permanent objects are not suffi-

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